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FLOOD INSURANCE STUDY

COMPLETED

CITY OF ELLSWORTH, MAINE
HANCOCK COUNTY

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NOVEMBER 4, 1988

Federal Emergency Management Agency

COMMUNITY NUMBER - 230066

ORIGINAL

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program (NFIP) have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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FLOOD INSURANCE STUDY
CITY OF ELLSWORTH, HANCOCK COUNTY, MAINE

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Ellsworth, Hancock County, Maine, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were prepared by the U. S. Geological Survey (USGS) for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. EMW-85-E-1823, Project Order No. 11. This work was completed in June 1987.

1.3 Coordination

Streams requiring detailed study were identified at an initial Consultation and Coordination Officer's (CCO) meeting attended by representatives of FEMA, the City of Ellsworth, and the USGS (the study contractor) in December 1984. During the course of the work by the USGS, flood elevations and flood boundaries were reviewed with community officials. An interim coordination meeting was held with Ellsworth city officials on June 1987 to review the study in progress.

On December 7, 1987, the results of the work were reviewed at a final CCO meeting attended by representatives of FEMA, the City of Ellsworth, and the study contractor.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Ellsworth, Hancock County, Maine. The area of study is shown on the Vicinity Map (Figure 1).

The Union River was studied by detailed methods: The first reach was from the Ellsworth-Trenton corporate limits to the head of tide (at the foot of Leonard Dam); the second reach was from the head of Leonard Dam to the foot of Graham Lake Dam. In addition, the shorelines of Graham, Branch, and Green Lakes within the City of Ellsworth were studied by detailed methods. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction through June 1992.

The following flooding sources were studied by approximate methods: Little Rocky Pond, Winkumpaugh Brook, Rocky Pond Branch, Graham Lake, Little Duck Pond, Boggy Brook, Cards Brook, Shackford Brook, Branch Lake Stream, Bog Pond, Sawpit Brook, Lower Patten Pond, Upper Patten Pond, Jesse Bog, Greys Brook, Gilpatrick Brook, and various unnamed brooks. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA and the City of Ellsworth.

2.2 Community Description

Ellsworth is located 29 miles southeast of Bangor and is the county seat of Hancock County. Ellsworth, in 1980, had a population of 5,179, an increase of 12.5 percent since 1970 (Reference 1). The land area of Ellsworth is 93.4 square miles (Reference 2). This gives a population density of approximately 55 people per square mile. Ellsworth has the largest area of any town or city in Maine. Ellsworth is bordered on the north by the Towns of Dedham and Otis; on the east by the Towns of Mariaville, T8 SD, Hancock, and Lamoine; on the south by the Towns of Trenton and Surry; and on the west by the Town of Orland.

Ellsworth is a small industrial and trading center for a large rural area along the Maine coast. Ellsworth's most distinctive natural feature is the 60-foot falls on the Union River at Leonard Dam. Ellsworth is an excellent outdoor recreation area, with its numerous lakes and its access to the Atlantic Ocean via the Union River (Reference 3).

The Union River flows in a southern direction from Great Pond (at an elevation of 291 feet) in the headwaters for approximately 48 miles to the head of tide at Ellsworth. There is a fall of 107 feet in the

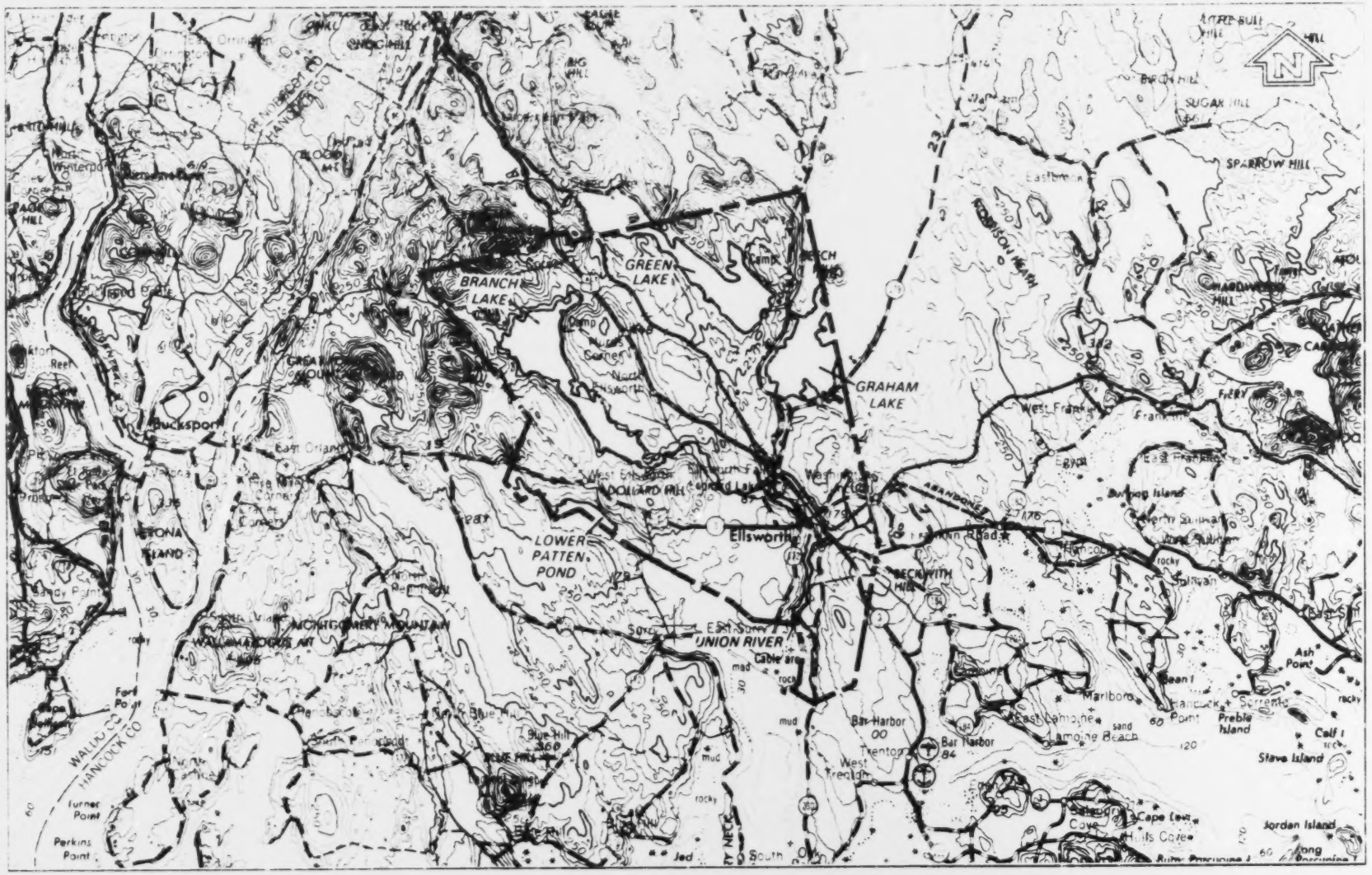

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF ELLSWORTH, ME

(HANCOCK CO.)

VICINITY MAP

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river from Graham Lake to the head of tide at Ellsworth. The Union River drains 563 square miles at its mouth.

Water levels of the three lakes studied in Ellsworth, Graham, Green, and Branch Lakes, are controlled by Bangor Hydro-Electric Company. The lakes are regulated to provide water for power generation at Leonard Dam. Leonard Dam is located downstream on the Union River near the center of Ellsworth and has a 60-foot head.

Graham Lake is located along the Union River and has a surface area of 7,865 acres. The maximum depth in the lake is 47 feet, and it drains a total of 499 square miles at its outlet.

Green Lake has a surface area of 2,089 acres. The maximum depth in the lake is 170 feet and it drains a total of 59.2 square miles at its outlet. Green Lake is one of the most popular recreational lakes located between Bangor and Ellsworth.

Branch Lake has a surface area of 2,703 acres. The maximum depth in the lake is 124 feet and it drains a total of 30.1 square miles at its outlet. Branch Lake is also a popular recreational lake.

The climate of Ellsworth is typified as humid continental, which means moderately comfortable summers with temperatures averaging between 60 degrees Fahrenheit (°F) and 67°F in July and August and fairly cold winters when temperatures average between 22°F and 23°F. The mean annual temperature is approximately 43°F and the average annual precipitation is approximately 49 inches which is distributed uniformly throughout the year (Reference 4).

2.3 Principal Flood Problems

Flooding in Ellsworth is limited to two reaches on the Union River, and Graham, Branch, and Green Lakes. A reach is a length of a stream between two specified locations. The studied reaches on the Union River are: Reach 1, from the Ellsworth-Trenton corporate limits to the head of tide (at the foot of Leonard Dam); and Reach 2, from the head of Leonard Dam to the foot of Graham Lake Dam. Flooding in Reach 2 in the Union River and along the shorelines of the lakes generally occurs in the spring months from rapid runoff caused by heavy rains combined with snowmelt and, less frequently, as a result of hurricanes. Flooding in Reach 1 of the Union River is caused by ocean surges at times of astronomical high tides and high winds.

Reach 1 on the Union River has recently been flooded by the February 2, 1976, and the January and February 1978 floods, all caused by ocean flooding as a result of large winter storms. The February 1976 flood was slightly less than a 100-year event, the January 1978 flood was approximately a 100-year event, and the February 1978 flood was slightly greater than a 100-year event. The events were 5.7, 5.8, and 6.3 feet above mean high water, respectively.

2.4 Flood Protection Measures

The natural stream flow of the Union River in Reaches 1 and 2 is greatly altered by Graham Lake Dam located upstream from Ellsworth. The dam with a storage capacity of 6.105 billion cubic feet (bcf) is owned and operated by Bangor Hydro-Electric Company (BHE). BHE also controls the 1.285 bcf of combined storage capacity in Green and Branch Lakes.

The City of Ellsworth has adopted the minimum shoreland zoning ordinance as required by the State of Maine (Reference 5). This ordinance serves to protect the shorelines by restricting building to reduce flood damage and problems.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. A flood event of a magnitude which is expected to be equaled or exceeded once on the average during any 100-year period (recurrence interval) has been selected as having special significance for floodplain management and for flood insurance rates. This event, commonly termed the 100-year flood, has a 1 percent chance of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied in detail affecting the community.

The principal source of flood-flow data for the Union River for Reach 2 in Ellsworth were annual maximum daily peak flows at the outlet of Graham Lake furnished by BHE for the period 1957-1986. The 100-year flood discharge for Reach 2 was computed by applying the log-Pearson Type III technique (Reference 6) to the annual peak flow data. The calculated 100-year flood discharge was increased by a drainage area ratio to account for the additional inflow from Branch Lake Outlet Stream.

The source of data for Reach 1 of the Union River were the Tidal Flood Profiles of the New Coastline (Reference 7).

The principal source of flood elevation data for Graham, Green, and Branch Lakes were records of annual maximum lake elevations furnished by BHE. These records were available for the period 1957-1986 for Green and Branch Lakes and for the period 1955-1986 for Graham Lake. The 100-year flood elevation for all three lakes was computed by applying the log-Pearson Type III technique to the annual peak elevation data (Reference 6).

A summary of the drainage area-peak discharge relationships for the flooding sources studied by detailed methods is shown in Table 1, "Summary of Discharges and Flood Elevations."

TABLE 1 - SUMMARY OF DISCHARGES AND FLOOD ELEVATIONS

Flooding Source and Location	Drainage Area (sq. miles)	Peak Discharges (cfs) 100-Year	Flood Elevation 100-Year Feet (NGVD)
UNION RIVER			
Reach One[1]: At Ellsworth-Trenton corporate limits	563	--	11.0
At Leonard Dam (just upstream of U. S. Route 1 bridge)	547	--	11.0
Reach Two[2]: At Leonard Dam (just upstream of dam)	547	17,800	69.6
Upstream of confluence of Branch Lake Outlet Stream	510	16,800	72.4
At Graham Lake Dam (just downstream of the dam)	499	16,800	94.6
GRAHAM LAKE			
Entire shoreline within community	499	--	106.8
BRANCH LAKE			
Entire shoreline within community	30.1	--	240.1
GREEN LAKE			
Entire shoreline within community	59.2	--	162.3

[1]100-year flood elevation is 11.0 for the entire reach
[2]Stage varies between sections in Reach 2, see Table 2 and the Flood Profiles

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the source studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross-section data for the Union River were obtained from the latest USGS topographic maps (Reference 8). The below-water portions of all cross sections were obtained from field surveys.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1) and the Flood Insurance Rate Map (Exhibit 2), where applicable.

Roughness coefficients (Manning's "n" values) for the Union River were estimated on the basis of the maps and field inspection at each cross section in the area studied. Roughness values for the main channel in Reach 2 varied between 0.030 and 0.040. In the overbank floodplains, the values ranged between 0.060 and 0.110. The Union River reaches studied include residential as well as rural woodland areas.

The water-surface elevations for the Union River were taken from profiles developed using a USGS step-backwater computer program model (Reference 9). The starting water-surface elevation used for the profile determinations for Reach 2 was critical depth at the head of Leonard Dam. The physical features of Leonard Dam were furnished by BHE Company and were field checked by the USGS.

The water-surface elevation for Reach 1 was taken from the Tidal Flood Profiles of the New England Coastline (Reference 7). The flood marks of February 2, 1976, and the January and February 1978 events were documented by the USGS and used in this report (References 10 and 11). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. The values of selected cross-sectional properties for the 100-year flood are shown in Table 2, "100-Year Flood Data," for the Union River.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps; the descriptions of the marks are presented in Elevation Reference Marks (Exhibit 3).

FLOODING SOURCE		RIVER CHANNEL				BASE FLOOD ELEVATION
CROSS SECTION	DISTANCE [1] (FT.)	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	STREAM-BED ELEVATION FT. (NGVD)	FT. (NGVD)
A	8,950	- -	- -	- -	-14.2	11.0
B	9,760	- -	- -	- -	-15.6	11.0
C	10,370	- -	- -	- -	-27.0	11.0
D	11,090	- -	- -	- -	-21.2	11.0
E	11,750	- -	- -	- -	-21.2	11.0
F	13,300	- -	- -	- -	-20.2	11.0
G	13,840	- -	- -	- -	-25.0	11.0
H	14,900	- -	- -	- -	-19.0	11.0
I	15,950	- -	- -	- -	-18.6	11.0
J	16,380	- -	- -	- -	-20.0	11.0

[1] Distance in thousands of feet upstream of Ellsworth-Trenton City Line

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

Federal Insurance Administration

ELLSWORTH, MAINE
(Hancock County)

100-YEAR FLOOD DATA

UNION RIVER

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FLOODING SOURCE		RIVER CHANNEL				BASE FLOOD ELEVATION
CROSS SECTION	DISTANCE [1] (FT.)	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	STREAM-BED ELEVATION FT. (NGVD)	FT. (NGVD)
K	17,000	- -	- -	- -	-19.7	11.0
L	17,570	- -	- -	- -	- 7.2	11.0
M	18,200	- -	- -	- -	-16.4	11.0
N	18,800	- -	- -	- -	-14.6	11.0
O	19,600	- -	- -	- -	-10.1	11.0
P	20,460	- -	- -	- -	-14.8	11.0
Q	20,900	- -	- -	- -	-14.2	11.0
R	21,530	- -	- -	- -	- 3.8	11.0
S	22,240	- -	- -	- -	- 6.8	11.0
T	22,900	- -	- -	- -	-11.2	11.0

[1] Distance in thousands of feet upstream of Ellsworth-Trenton City Line

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TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

Federal Insurance Administration

ELLSWORTH, MAINE
(Hancock County)

100-YEAR FLOOD DATA

UNION RIVER

FLOODING SOURCE		RIVER CHANNEL				BASE FLOOD ELEVATION
CROSS SECTION	DISTANCE [1] (FT.)	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	STREAM-BED ELEVATION FT. (NGVD)	FT. (NGVD)
U	23,400	- -	- -	- -	-10.1	11.0
V	23,960	- -	- -	- -	- 5.4	11.0
W	24,520	- -	- -	- -	- 4.8	11.0
X	25,160	- -	- -	- -	- 5.3	11.0
Y	25,500	- -	- -	- -	- 4.7	11.0
Z	25,860	- -	- -	- -	- 4.0	11.0
AA	26,100	- -	- -	- -	- 4.3	11.0
AB	26,600	- -	- -	- -	- 2.2	11.0
AC	27,130	- -	- -	- -	- 3.0	11.0
AD	27,380	- -	- -	- -	- 7.3	11.0

[1] Distance in thousands of feet upstream of Ellsworth-Trenton City Line

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

Federal Insurance Administration

ELLSWORTH, MAINE
(Hancock County)

100-YEAR FLOOD DATA

UNION RIVER

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FLOODING SOURCE		RIVER CHANNEL				BASE FLOOD ELEVATION
CROSS SECTION	DISTANCE [1] (FT.)	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	STREAM-BED ELEVATION FT. (NGVD)	FT. (NGVD)
AE	27,600	303	1,440	12.4	64.5 [2]	69.6
AF	28,280	728	15,900	1.1	8.6	72.2
AG	29,350	568	15,400	1.2	12.5	72.2
AH	30,880	1,800	50,200	0.4	15.8	72.2
AI	32,750	746	15,200	1.2	32.7	72.2
AJ	33,650	548	5,500	3.2	52.0	72.2
AK	34,600	395	2,610	6.4	54.8	72.4
AL	35,220	318	2,760	6.1	59.3	73.7
AM	36,500	806	6,970	2.4	49.8	74.9
AN	36,700	817	6,810	2.5	56.4	75.0

1 Distance in thousands of feet upstream of Ellsworth-Trenton City Line

2 Crest of Dam

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

Federal Insurance Administration

ELLSWORTH, MAINE
(Hancock County)

100-YEAR FLOOD DATA

UNION RIVER

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FLOODING SOURCE		RIVER CHANNEL				BASE FLOOD ELEVATION
CROSS SECTION	DISTANCE [1] (FT.)	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	STREAM-BED ELEVATION FT. (NGVD)	FT. (NGVD)
AO	37,000	818	6,570	2.6	59.3	75.1
AP	37,800	205	2,130	7.9	60.6	75.1
AQ	38,300	882	10,400	1.6	74.1	93.7
AR	38,950	1,000	12,400	1.4	72.8	93.7
AS	39,250	1,010	12,700	1.3	73.1	93.7
AT	39,600	1,020	9,120	1.8	74.3	93.7
AU	40,500	905	8,530	2.0	57.3	93.8
AV	41,460	1,700	15,800	1.1	64.4	94.0
AW	42,100	2,270	16,600	1.0	64.5	94.1
AX	42,700	1,920	14,100	1.2	57.3	94.1

[1] Distance in thousands of feet upstream of Ellsworth-Trenton City Line

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TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

Federal Insurance Administration

ELLSWORTH, MAINE
(Hancock County)

100-YEAR FLOOD DATA

UNION RIVER

FLOODING SOURCE		RIVER CHANNEL				BASE FLOOD ELEVATION
CROSS SECTION	DISTANCE [1] (FT.)	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	STREAM-BED ELEVATION FT. (NGVD)	FT. (NGVD)
AY	43,250	2,650	20,200	1.3	70.7	94.1
AZ	43,830	1,730	13,000	0.8	65.5	94.2
BA	44,620	2,390	19,900	1.3	66.3	94.2
BB	45,000	1,820	14,300	0.8	67.8	94.3
BC	45,400	1,170	11,300	1.2	67.9	94.3
BD	46,650	794	8,630	1.5	70.0	94.4
BE	47,280	731	7,730	2.0	74.7	94.4
BF	47,850	751	12,400	2.2	70.9	94.5
BG	48,250	5,390	8,520	1.4	61.8	94.6
BH	48,950	1,900	13,400	2.0	67.4	94.6

[1] Distance in thousands of feet upstream of Ellsworth-Trenton City Line

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

Federal Insurance Administration

ELLSWORTH, MAINE
(Hancock County)

100-YEAR FLOOD DATA

UNION RIVER

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4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100-year floodplain boundaries to assist communities in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. For the flooding sources studied in detail, the 100-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24,000 with a contour interval of 20 feet, 3 meters, and 6 meters (Reference 8).

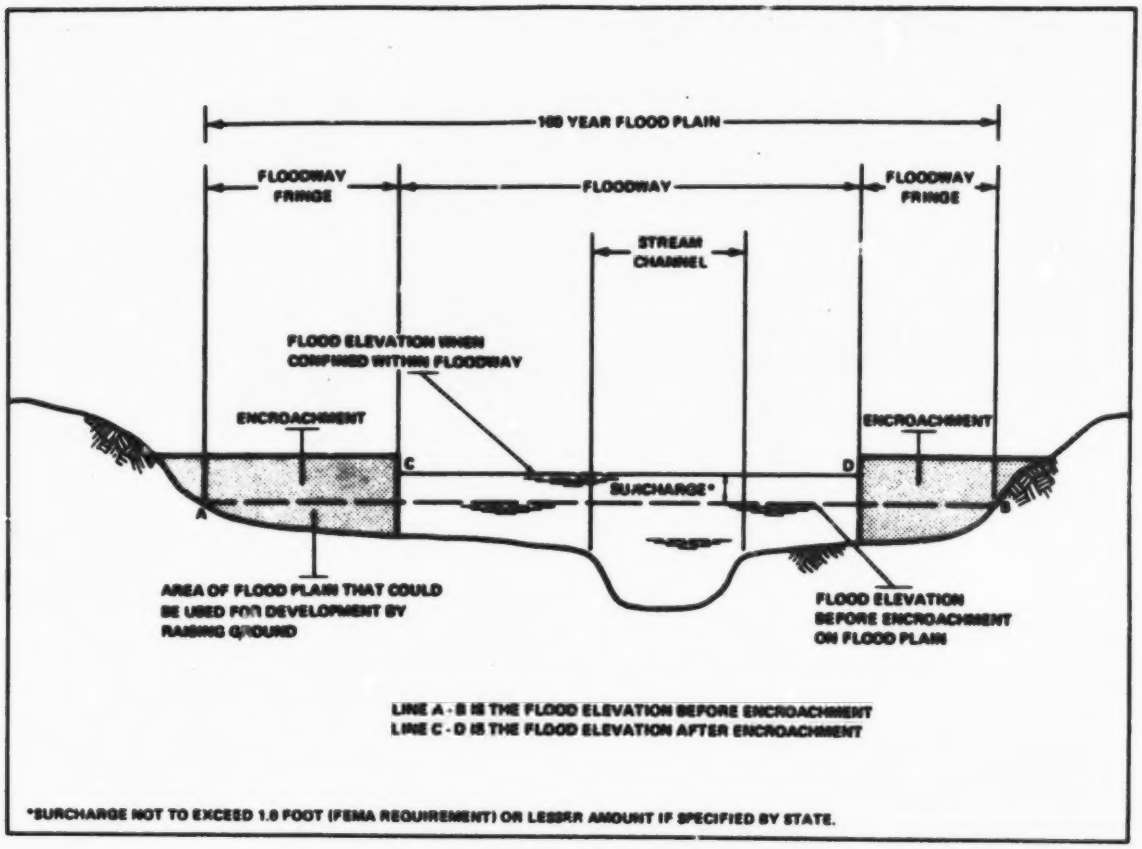
For the flooding sources studied by approximate methods, the boundary of the 100-year flood was delineated using the Flood Hazard Boundary Map for the City of Ellsworth (Reference 12).

The 100-year floodplain boundaries are shown on the Flood Insurance Rate Map (Exhibit 2). On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE). Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced.

The area between the floodway and 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FLOODWAY SCHEMATIC Figure 2

No floodways were calculated as part of this study.

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

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Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. In most instances, whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.

Zone A99

Zone A99 is the flood insurance rate zone that corresponds to areas of the 100-year floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or depths are shown within this zone.

Zone V

Zone V is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no base flood elevations are shown within this zone.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain, and to areas of 100-year flooding where average depths are

less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

Zone D

Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 100-year floodplain. The locations of selected cross sections used in the hydraulic analyses are shown where applicable.

7.0 OTHER STUDIES

Due to its more detailed nature, this study supersedes the Flood Hazard Boundary Map for the City of Ellsworth (Reference 12).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting FEMA, the Natural and Technological Hazards Division, J. W. McCormack Post Office and Courthouse Building, Room 462, Boston, Massachusetts 02109.

9.0 BIBLIOGRAPHY AND REFERENCES

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2. State of Maine, State Planning Office, City Land Area, Augusta, Maine, April 1, 1980.

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4. U. S. Department of Commerce, National Oceanic and Atmospheric Administration, Climatological, Annual Summary, New England, 1984, Washington, D. C., 1984.

5. State of Maine, Guidelines for Municipal Shoreland Zoning Ordinances, Augusta, Maine, December 15, 1973.

6. U. S. Department of the Interior, Geological Survey, Office of Water Data Collection, Interagency Advisory Committee on Water Data, "Guidelines for Determining Flood Flow Frequency," Bulletin 17B, Reston, Virginia, Revised September 1981.

7. U. S. Army Corps of Engineers, Tidal Flood Profiles of the New England Coastline, Waltham, Massachusetts, 1980.

8. U. S. Department of the Interior, Geological Survey, 7.5-Minute Series Topographic Maps, Scale 1:24,000, Contour Interval 20 Feet, 3 meters, and 6 meters: Branch Lake, Maine, 1981; Newbury Neck, Maine, 1981; Ellsworth, Maine, 1981; Beech Hill, Maine, 1981.

9. Federal Highway Administration, Report FHWA/RD-86, Bridge Waterways Analysis Model/Research Report by James O. Shearman and others, Washington, D. C., 1986.

10. U. S. Department of the Interior, Geological Survey, Professional Paper 1087, Maine Coastal Storm and Flood of February 2, 1986, Augusta, Maine.

11. U. S. Department of the Interior, Geological Survey, Water-Resources Investigations 79-61, Coastal Flood of February 7, 1978 in Maine, Massachusetts, and New Hampshire, Boston, Massachusetts.

12. U. S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, City of Ellsworth, Hancock County, Maine, July 19, 1974 (Revised August 27, 1976).

EXHIBIT 3 - ELEVATION REFERENCE MARKS

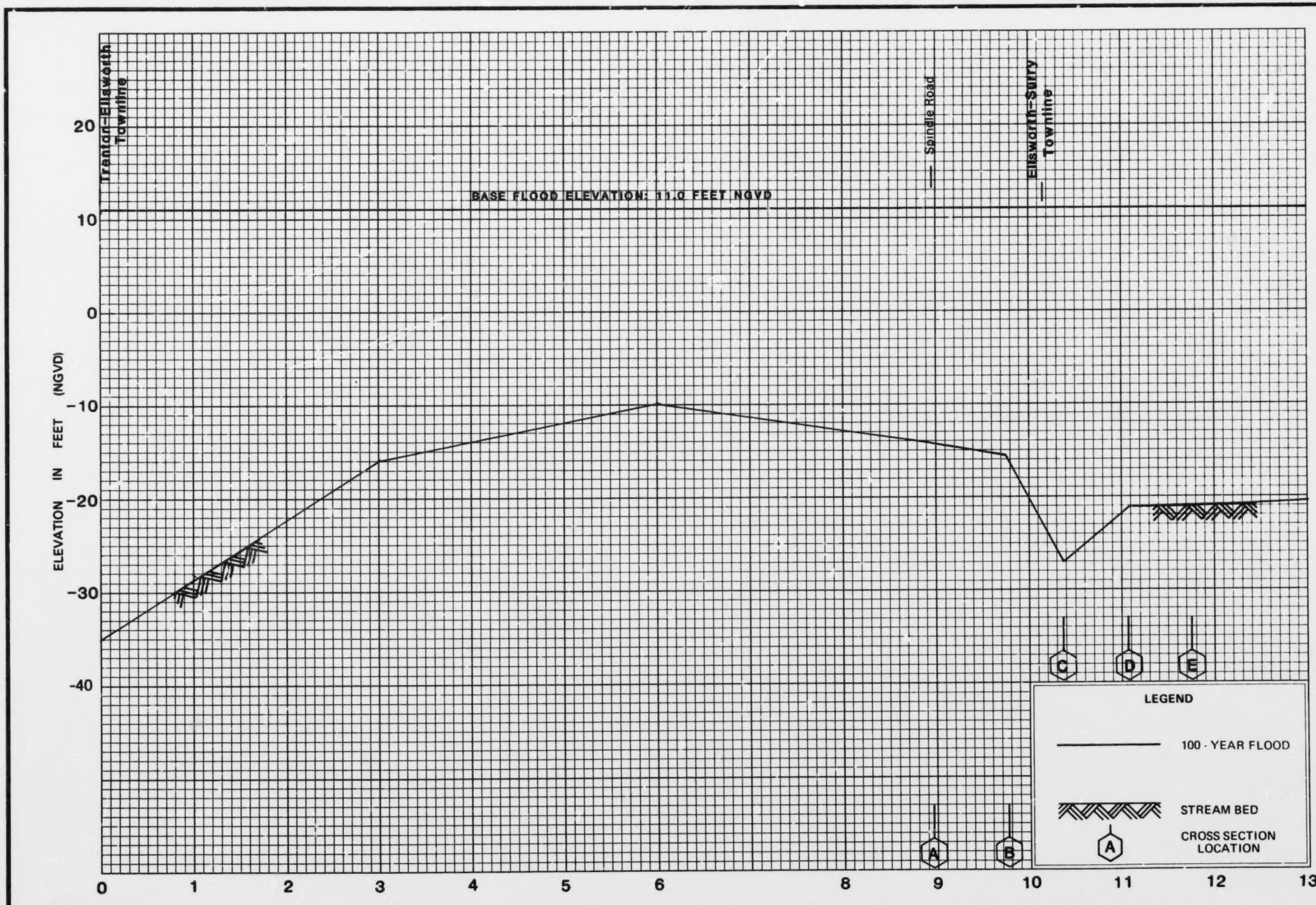
Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 1	10	181.404	Standard USC&GS disk stamped 181 ME set in top of rock outcrop with approximately 40 feet by 20 feet of exposed surface, 5.4 miles north of Ellsworth Falls along State Highway 180, 0.3 mile north of bridge over Graham Lake outlet, approximately 240 feet south of curve in road with tangent extending south and northeast and center of junction of gravel road leading north, 47 feet west of centerline of highway, 70 feet northwest of telephone pole no. 203, and 8 feet west of east edge of outcrop.
RM 2	10	191.630	Standard USC&GS bronze disk stamped D 77 1935, set on top of large sloping rock outcrop near top of hill, 4.7 miles north along State Highway 180, 0.4 mile south of bridge over Graham Lake outlet, 43 feet northwest of center line of highway and 162 feet north of power pole no. 138-BHE-E1473.
RM 3	10	129.347	Standard USC&GS disk stamped C 77 1935, 3.8 miles north of junction of State Highway 180 and U. S. Route 1A at Ellsworth Falls, 27 feet northwest of center line of highway, 93 feet southwest of center line of woods road leading northwest, 64 feet northeast of northwest end of 18-inch pipe culvert, 101 feet southwest of power pole no. 122-BHE-E1457 and approximately 2 feet above level of highway.
RM 4	20	145.323	USGS aluminum tablet stamped 145 set in face of large boulder, 2.6 miles northwest of Ellsworth Falls, on State Highway 180, 150 feet east of road in field.
RM 5	20	103.713	Standard USC&GS bronze disk stamped B 17 1935, 31 feet northeast of center line of State Highway 180, 29 feet northwest of center line of State Highway 179 and 8 feet northeast of power pole no. 82/66.

EXHIBIT 3 - ELEVATION REFERENCE MARKS (continued)

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 6	20	108.594	Standard USC&GS bronze disk stamped T 159 1966, 0.25 mile northwest of Ellsworth Falls along Maine Central Railroad from crossing of State Highway 179, 8 1/2 rails southeast of railroad bridge no. P164/C106, 27 feet southwest of the southwest rail, in top of southeast end of layer of bedrock 35 feet x 45 feet, 54 feet northeast of centerline of U. S. Route 1A, 3 feet northwest of southeast end of rock and approximately 4 feet above level of track.
RM 7	20	108.681	Standard USC&GS disk stamped J 90 1942, set in top of 3 by 6 foot rock ledge on northwest bank of small stream, approximately 1.3 mile southeast along Maine Central Railroad from crossing of State Highway 179 at Ellsworth Falls, approximately 1.3 miles northwest of old brick station at Ellsworth, approximately 0.2 mile northwest of milepost no. P165/C105, 20 feet north of northeast end of 5-foot pipe culvert, 1 1/2 feet northwest of southeast end of rock and approximately 3 feet below level of track.
RM 8	20	24.278	Standard USC&GS bronze disk stamped 24, on State Route 3 and 0.25 mile south of railroad station in foundation of Union Trust Company building (formerly Ellsworth Trust Company).
RM 9	20	121.718	Standard USC&GS bronze disk stamped R 145 1962, set on top of 8 foot by 8 foot boulder which projects 4 feet above ground, on property of Ralph B. Cushman, approximately 0.2 mile west along U. S. Route 1 from post office in Ellsworth, 0.5 mile southwest along State Highway 172, 97 feet northwest of centerline of highway, 108 feet northeast of northeast corner of large white frame house, 18 feet southeast of centerline of driveway and approximately 6 feet above level of highway.

EXHIBIT 3 - ELEVATION REFERENCE MARKS (continued)

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 10	20	207.827	Standard USC&GS disk stamped CH 11 1942, painted PBM 270.9, set in rock ledge, 2 miles southeast of North Ellsworth, 50 feet south and 65 feet east of Y road junction of Old Bangor Road and Branch Lake Road.
RM 11	25	129.263	Standard USC&GS disk stamped S 145 1962 set on top of large flat outcrop projecting 1 foot above level of ground, approximately 0.2 mile west along U. S. Route 1 from U. S. Post Office at Ellsworth, 1.5 miles southwest along State Highway 172, 48 feet southeast of centerline of highway, 24 feet northeast of northeast corner of two-story frame house, 15 feet east of 30-inch pine tree in yard and approximately 3 feet above level of highway.
RM 12	25	136.481	Standard USC&GS disk stamped T 145 1962 set on top and southwest end of 5 foot by 5 foot boulder projecting 3 feet above level of ground, approximately 0.2 mile west along U. S. Highway 1 from U. S. Post Office at Ellsworth, 2.4 miles southwest along State Highway 172, 75 feet southeast of centerline of highway, 7 feet north of north corner of one-story frame house and approximately level with highway.
RM 13	25	44.719	Standard USC&GS disk stamped K 5 1934 set on large boulder and near small brook, 3.8 miles south along Bayside Road from Ellsworth, 100 feet east of road and on east side of large heap of boulders.



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FLOOD PROFILES

UNION RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

ELLSWORTH, MAINE

(Hancock County)

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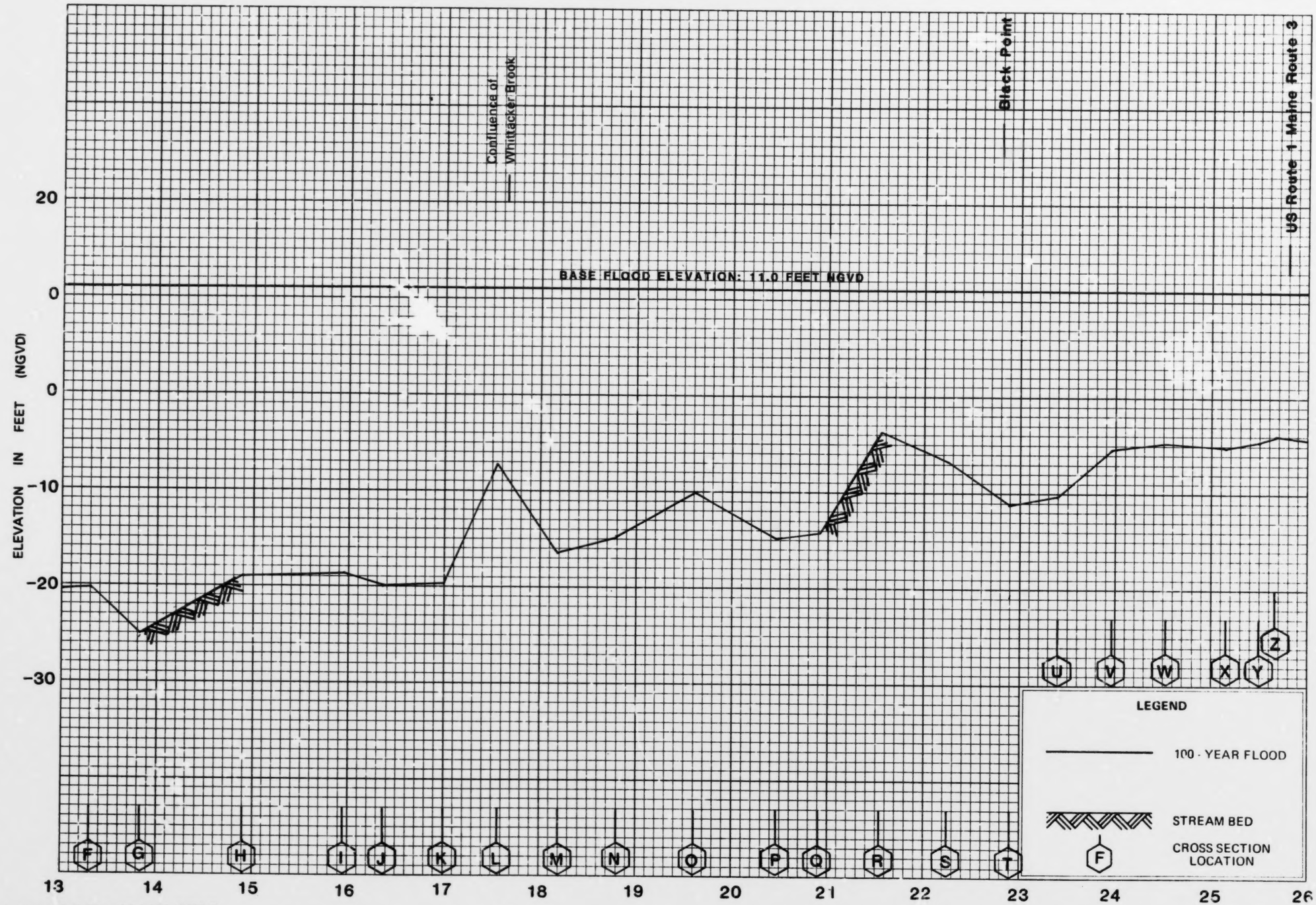

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UNION RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

ELLSWORTH, MAINE

(Hancock County)

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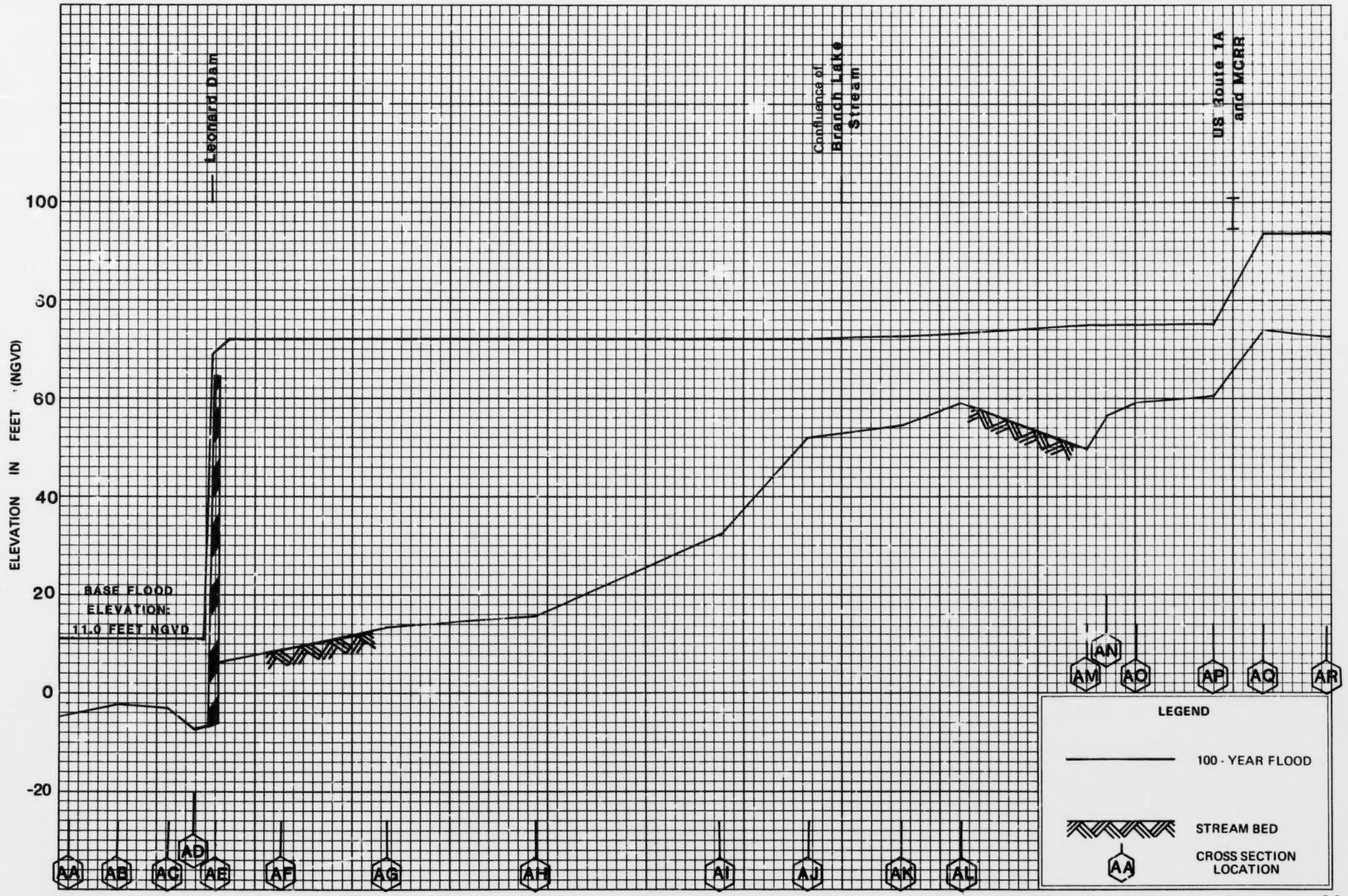

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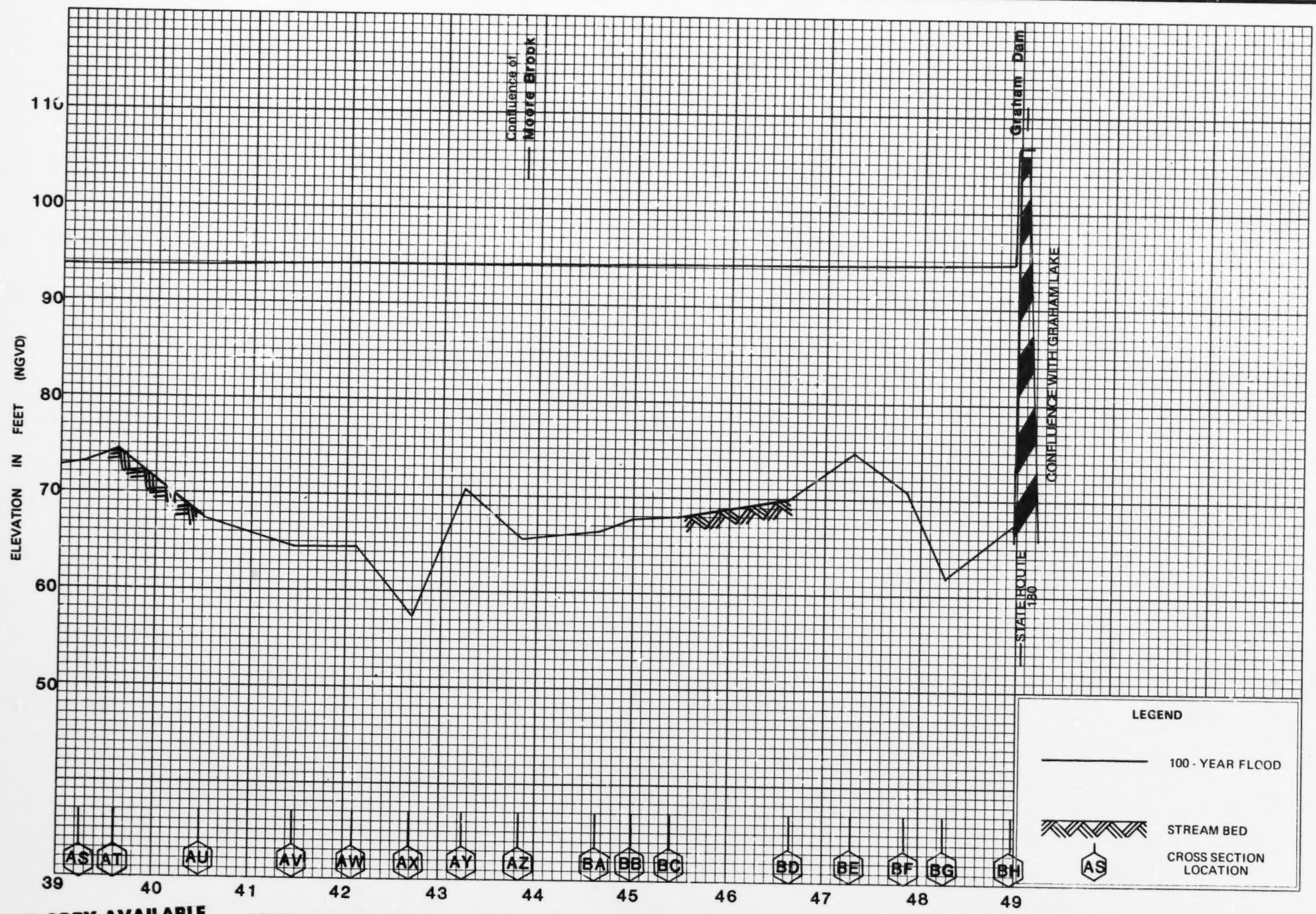

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